(11) AU-A1 33135/78

(12) PATENT SPECIFICATION
ABSTRACT
(19) AU

(21) 33135/78 (22) 8.2.77 (23) 8.2.78 (24) 8.2.77
(43) 16.8.79
(51)[2] A01C 23/04 B65G 53/30 B01J 2/00 B29B 1/03
(54) DISSOLVING BONDED COMPRESSED CARTRIDGES
(71) AQUAFEED INDUSTRIES PTY. LTD.
(72) WAKE D.L. AND ENGLISH R.L.
(74) PO
(57) CLAIM

1. Material distributing apparatus including, a compartment for receiving material to be distributed and having a removable cover; a fluid transfer line connectable to a fluid source at one end and to a distribution outlet at its other end; a fluid inlet and a fluid outlet, each connecting said transfer line to the interior of said compartment; said inlet and outlet connecting with said compartment interior at spaced locations; valve means operable to selectively prevent or allow fluid to flow from said transfer line through said compartment and back into said transfer line; and a by-pass forming part of said transfer line and through which fluid can flow from one end of said transfer line to the other irrespective of the operative condition of said valve means.

..2

11. A soluble fertilizer cartridge having a plurality of different nutrients dispersed substantially regularly throughout the body thereof.

12. A method of manufacturing a soluble cartridge of material, including the steps of, mixing a plurality of selected ingredients, reducing said mixture to a powder-like consistency, introducing a binding agent to said reduced mixture to produce a substantially homogenous slurry, separating measured quantities of said slurry on a sequential basis, and compressing each said separated quantity to form a rigid slug of material.

Patents Act

COMPLETE SPECIFICATION

(ORIGINAL)

33135/78

Class Int. Class

Application Number:

Lodged:

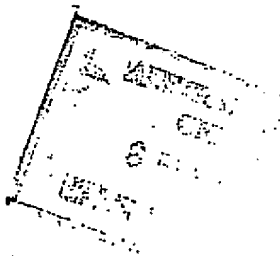
Complete Specification Lodged:

Accepted:

Published:

Priority:

Related Art:



APPLICANT'S REF.: CAP of PC 8992/77

Name(s) of Applicant(s): AQUAFEED INDUSTRIES PTY. LTD.
~~DAVID LEIGH WAKE~~

Address(es) of Applicant(s): 2 LEURA ST., HOLLYWOOD.
~~Floreat Park 6014~~, Western Australia, Australia
6009

Actual Inventor(s):

David Leigh Wake and Raymond Lawrence English

Address for Service is:

PHILLIPS, ORMONDE & FITZPATRICK
Patent and Trade Mark Attorneys
NEW ADDRESS
367 Collins Street
Melbourne 3000 Australia
Telephone (03) 614 1944
Telex AA 34316

Complete Specification for the invention entitled:

"MATERIAL DISTRIBUTING APPARATUS, SYSTEM, AND MATERIAL CARTRIDGE FOR USE THEREWITH"

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

materials such as fertilizers. Although the invention has application to a relatively wide range of materials, it will be convenient to hereinafter describe the invention with particular reference to fertilizer.

Distribution of fertilizers has always been a problem in agricultural establishments requiring maintenance of suitable growth conditions for crops, but the problem has become more widespread with the increasing use of fertilizers at domestic levels - i.e., for use on lawns and gardens. A difficulty common to all levels of use is the need for regular distribution of the fertilizer over a given area. It also happens that many fertilizers comprise several different nutrients, and optimum results are achieved when a particular balance of those constituents is deposited. In practice however, it is common to find that the dispersion of fertilizer is irregular, and that the distribution of nutrients is not in the correct proportions and/or the proportion varies greatly over the dispersion area.

A principal object of the present invention is to provide apparatus for distributing material in a controllable and regular fashion. It is a further object of the invention to provide a material dispersion system which includes such apparatus and which is effective to enable selective and efficient treatment of tracts of land. Yet another object of the invention is to provide a material cartridge for use in such apparatus and which is adapted to respond to immersion of water or other fluid to progressively release its constituents in a regular and balanced manner. Still another object of the invention is to provide an improved method of forming soluble fertilizer cartridges.

provided material distributing apparatus including, a compartment for receiving material to be distributed and having a removable cover, a fluid transfer line connectable to a fluid source at one end and to a distribution outlet at its other end, a fluid inlet and a fluid outlet, each connecting said transfer line to the interior of said compartment, said inlet and outlet connecting with said compartment interior at spaced locations, valve means operable to selectively prevent or allow fluid to flow from said transfer line through said compartment and back into said transfer line and a by-pass forming part of said transfer line and through which fluid can flow from one end of said transfer line to the other irrespective of the operative condition of said valve means.

In accordance with a further aspect of the invention, there is provided a soluble fertilizer cartridge having a plurality of different nutrients dispersed substantially regularly throughout the body thereof.

According to yet another aspect of the invention, there is provided a method of manufacturing a soluble cartridge of material, including the steps of, mixing a plurality of selected ingredients to achieve a state of substantially regular distribution, reducing said mixture to a powder-like consistency, introducing a binding agent to said reduced mixture to produce a substantially homogenous slurry, separating measured quantities of said slurry on a sequential basis, and compressing each said separated quantity to form a rigid slug of material.

The essential features of the invention, and further optional features, are described in detail in the following passages of the specification which refer to the accompanying

how the invention might be put into effect, so that the specific form and arrangement of the features (whether they be essential or optional features) shown is not to be understood as limiting on the invention.

In the drawings:

Figure 1 is a perspective view of an example apparatus according to the invention;

Figure 2 is a plan view of the apparatus shown in figure 1;

Figure 3 is a cross-sectional view taken along line III-III of figure 2;

Figure 4 is an enlarged cross-sectional view of the control valve, showing the valve in the closed condition;

Figure 5 is a view similar to figure 3 but showing a cartridge in place;

Figure 6 is a flow chart diagrammatically illustrating one form of material dispersion system according to the invention;

Figure 7 is an enlarged cross-sectional view of the one-way valve shown in figure 6;

Figure 8 is a diagrammatic representation of a process for forming a cartridge to be used with the apparatus.

The example construction of the apparatus as shown in figures 1-4 of the drawings, includes a compartment 2 having a removable cover 3, and a fluid transfer line 4 which connects with the interior of the compartment 2 through both a fluid inlet 5 and a fluid outlet 6 (figure 3). The ends 7 and 8 of the transfer line 4 are formed as conduit connections so as to be respectively connectable to a fluid source 9 and a dispersion outlet 11 (figure 6). The fluid source 9 may be

outlet 11 may be a spray head or other distribution device such as a length of perforated tubing. Obviously a plurality of distribution outlets 11 can be provided as shown diagrammatically in figure 6.

In the particular construction shown, the compartment 2 is formed by a cylindrical side wall 12 having its opposite ends connected to head and base members 13 and 14 respectively. The wall 12 may be transparent to permit a user to readily determine the state of the contents of the compartment 2, and it may be formed of a suitable plastics material such as PVC. The members 13 and 14 may also be injection moulded from PVC, although that is not essential.

The head member 13 comprises an annular wall section 15 which receives an end portion of the wall 12 at its lower end, and has an external thread 16 at its opposite end for cooperative engagement with the cover 3. It will be appreciated however, that other forms of attaching means may be employed to releasably secure the cover 3 to the compartment 2. A lateral arm 17 is secured to or formed integral with the section 15 and has two interconnected passages 18 and 6 formed therein. The passage 18 constitutes part of the transfer line 4, and the passage 6 is the aforementioned fluid outlet. Other arrangements are obviously possible - for example, the outlet 6 may be formed by a separate conduit which is connected into the transfer line 4 through a suitable junction.

A control valve 19 is shown provided in the outlet 6, but other locations for that valve may be selected according to requirements. In the particular embodiment

shown (figure 3), the valve 19 includes a flexible sleeve 21 located within the outlet 6, and a screw threaded stem 22 which engages with a cooperable thread formed in the outlet wall 23. The stem 22 can be axially adjusted through manipulation of a connected knob 24, and is operable to pinch the sleeve 21 between its ends to effect a fully closed condition as shown in figure 3, or a partially closed condition (not shown) according to requirements. Such a valve permits effective control of the fluid flow rate through the compartment 2, but other types of valves could be used with equal effectiveness.

331357/78

As best seen in figure 1, a hook element 25 is formed integral with the arm 17, although it may be otherwise attached to the apparatus, and that serves to mount the apparatus on a support such as a conduit as used in a domestic water supply system. Other means may be used for that purpose in variations of the construction shown.

The cover 3 has a skirt section 26 which is internally threaded for cooperation with the thread 16 of the member 13, and a handle 27 enables convenient removal and replacement of the cover 3.

The base member 14 is provided with two interconnected passages, 28 and 5. The passage 28 forms part of the transfer line 4,and the passage 5 is the aforementioned fluid inlet. A conical recess 29 is provided in the member 14, and the inlet passage 5 preferably connects centrally with that recess 29 as shown in figures 3 and 5. A cylindrical bore 31 in the upper part of the member 14 is adapted to receive an end portion of the wall 12. In the assembled condition of the apparatus, the wall 12 may be secured to the members 13 and 14

A conduit 32 connects the two passages 18 and 28 and constitutes a by-pass section of the transfer line 4 which functions as hereinafter described. The conduit 32 may be connected to the members 13 and 14 in the same manner as the cylindrical wall 12.

331357/8

It is desirable to create a pressure differential between the inlet 5 and outlet 6 so that in use, water entering the transfer line 4 is subjected to back pressure so that the incoming stream is split into two paths, one of which moves through the inlet 5 and impinges on a cartridge 33 contained in the compartment 2 (see figure 5). As subsequently explained in greater detail, the cartridge is soluble, so that impingement of water on the cartridge causes it to gradually dissolve and to produce a nutrient enriched solution (in the case of a fertilizer type cartridge) which enters the main flow of water through transfer line 4, by way of the outlet 6. In the construction shown, the aforementioned pressure differential is created by means of a venturi 34, and it is preferred to arrange the outelt 6 so that it communicates with the venturi 34 at or adjacent the throat 35 of the venturi.

A one way valve 36 may be attached to the apparatus, or included in a system incorporating that apparatus (e.g., see figure 6), so as to guard against contamination of the main water supply by nutrients from the cartridge 33. Figure 7 shows one form of valve 36 which includes two separate valve discs 37 and 38 arranged in series, and each of which is urged against a respective valve seat by a spring 39 and 41 respectively. The housing of the valve 36 is conveniently made from two parts 42 and 43 which are attached through a

them. The upper part 42 of the housing may be attached to the apparatus at the threaded end 7 of that apparatus, but it could also be located remote from that apparatus if desired. A perforated plate 45 may be clamped between the apparatus end 7 and a shoulder 46 of the housing part 42 so as to serve as a retainer for the spring 39. The disc 37, or a member attached thereto, can serve as a retainer for the spring 41.

331357/8

If desired, a vacuum-break facility may be provided in the valve 36, and in the construction shown in the drawings that is achieved by way of spring influenced valve element 47 adapted to close a port 48 through a wall of a compartment 49 formed between the valve seats for the discs 37 and 38. A stem 51 attached to the valve element 47 projects out of the housing part 43 so as to be exposed for manual engagement. Thus, depression of the stem 51 into the housing part 43 causes opening of the port 48. Alternatively, the valve element 47 may be automatically urged to open the port 48 in response to a pressure differential resulting from formation of a partial vacuum within the compartment 49.

A cartridge 33 may be formed from any appropriate ingredient according to desired use. For example, the cartridge 33 may have a fertilizer base formed by one or more nutrients, and it may have other substances or additives included according to requirements. At least some of the basic ingredients will be normally supplied in dry granular form, and consequently a binder such as water is generally required to create a cohesive cartridge structure. The cartridge 33 can be manufactured in many different ways, but the following

been found particularly suitable for cartridges having a fertilizer base.

The dry ingredients are preferably batched and mixed in the required proportions, and the resulting mix 52 is then reduced by milling, pulverizing, or other suitable process, as at 53, to achieve a powder-like consistency. The resulting body 54 of reduced material may be blended, for example, in a tumble mixer 55, to achieve substantially regular distribution of the various ingredients. The body 56 of blended ingredients is then divided into separate batches 57, each being of a predetermined size or quantity, and each batch is dropped in turn through a mist or spray 58 of liquid binder. Water may be used as the binder, and use of a mist or fine spray ensures that there is maximum dispersion of the water throughout the batch. That is, most if not all of the particles will be directly contacted by the water in passing through the mist or spray 58. It is generally found, for fertilizer cartridges, that each batch 57 should receive approximately 3% by weight of water during passage through the mist or spray 58, but satisfactory results may be achieved if the quantity of water is in the range 2-8% by weight. It is to be appreciated that a plurality of successive batches 57 may not exist immediately after blending as is shown in figure 8, but in an alternative each batch 57 may pass through the mist or spray 58 immediately it is separated from the main body 56 so that there is at that time only one batch 57 between the body 56 and the moistened batches 59.

Each moistened batch 59 is compressed as at 61 to form a slug 62, which is preferably cylindrical although other

depend upon end requirements. Usually, the aim is to achieve a sufficiently dense cartridge structure such as to hinder rapid inward penetration of water during eventual use of the cartridge, but to rather promote progressive external erosion. That has the advantage of enabling a partially used cartridge to be removed intact from the apparatus when desired, and also ensures that there is a substantially consistent proportion of each ingredient in the solution created by erosion of the cartridge. By way of example, a cartridge 95 mm. in diameter and 250 mm. in length, weighing approximately 2 kg., is preferably of such a density that, in use, it will completely dissolve in 30-40 minutes when subjected to water pressure of 40-100 p.s.i.

331378

The slugs 62 are fed in turn, or in a group, into a drying over 63 which is preferably of the infra-red type, and the slugs contained therein are heated for a predetermined period of time (e.g. 5 minutes). The resulting cartridges 33 are removed from the oven 63 and left to cool before packaging in plastic sleeves or other appropriate covering.

When a cartridge 33 is incorporated in apparatus as described, and that apparatus forms part of a system such as that shown in figure 6, dispersion of fertilizer is achieved in the following manner. Assuming the valve 19 is closed as shown in figure 4, and the transfer line 4 is open to supply from the fluid source 9, there will be flow of fluid through the transfer line 4 but not through the compartment 2. Some water may enter the compartment 2, but as there is no flow through the compartment there will be no turbulence and consequently little or no erosion of cartridge

If the valve 19 is opened however, so that flow occurs through the compartment 2 as shown in figure 5, the venturi 34 serves to promote passage of water through the compartment 2 because of the back pressure created in the transfer line 4 and the low pressure region created immediately upstream of the venturi throat 35. The extent of the flow will be dependent on the degree to which valve 19 is opened and that will be selected according to the desired rate of dispersion of the fertilizer taken into solution from the cartridge 33. Water flowing through the compartment 2 is subjected to turbulence because of the barrier created by the cartridge 33, and also because of the effect of the conical recess 29 formed by the base member 14. It is also possible that the cartridge 33 will be subjected to slight flotation because of movement of water from the base member 14 into the space between the cartridge 33 and cylindrical wall 12. As a result, water flowing from the inlet 5 to the outlet 6 impinges on the total surface area of the cartridge 33, and as that flow is of a turbulent nature the cartridge is progressively dissolved to create a nutrient enriched solution which emerges from the compartment 2 through the outlet 6. That solution enters the main body of water flowing through transfer line 4, at the venturi throat 35. A further consequence of the conical recess 29 is that it minimizes the possibility of the cartridge 33 obstructing flow of water from the inlet 5 into the compartment 2.

It is to be understood that all or some of the operative ingredients of the cartridge 33 may not be soluble,

surrounding fluid body rather than into solution. Since the water surrounds the cartridge 33, and the cartridge is of substantially uniform structure, disintegration or erosion will occur over the entire surface area of the cartridge 33. Thus, in use, there will be a progressive and simultaneous decrease in both the diameter and length of the cartridge 33. When a cartridge is completely dissolved, it is a relatively simple matter to introduce a new cartridge into the compartment 2 by first closing the supply of water to the apparatus and then removing the cover 3. Under some circumstances, the user may wish to remove a partially dissolved cartridge for subsequent re-use, and that is easily accomplished through the access provided by the cover 3.

331357/78

In the particular apparatus shown in the drawings, the axis of the compartment 2 slopes upwardly and outwardly relative to the axis of the transfer line 4. That is not essential, but is generally preferred as it facilitates removal and replacement of the cover 3.

A fertilizer distributing system incorporating apparatus and a cartridge as described, enables fertilizer to be selectively delivered to a tract of land in a desired concentration and at a controlled rate. Furthermore, that fertilizer is adapted for ready penetration into the ground because it is delivered in solution or liquid suspension. The apparatus is relatively simple yet effective, and is designed to promote substantially regular disintegration or erosion of a cartridge contained therein. The structure of the cartridge is such that it will disintegrate or erode when immersed in a flowing stream of water, and so that a

on the downstream side of the cartridge.

It will be appreciated that the apparatus described is adaptable for use in various distribution systems. Furthermore, the cartridge need not be a fertilizer cartridge, but could be formed of appropriate ingredients for some other purpose.

Finally, it is to be understood that various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the invention as defined in the appended claims.

1. Material distributing apparatus including, a compartment for receiving material to be distributed and having a removable cover; a fluid transfer line connectable to a fluid source at one end and to a distribution outlet at its other end; a fluid inlet and a fluid outlet, each connecting said transfer line to the interior of said compartment; said inlet and outlet connecting with said compartment interior at spaced locations; valve means operable to selectively prevent or allow fluid to flow from said transfer line through said compartment and back into said transfer line; and a by-pass forming part of said transfer line and through which fluid can flow from one end of said transfer line to the other irrespective of the operative condition of said valve means.

2. Apparatus according to claim 1, wherein said valve means is adjustable between fully opened and fully closed conditions so as to regulate the rate of flow of fluid through said compartment, and thereby regulate the concentration of said material in the fluid flow at said discharge outlet.

3. Apparatus according to claim 1 or 2, wherein said valve means is provided in said fluid outlet.

4. Apparatus according to any preceding claim, wherein said fluid inlet is located closer to said one end of the transfer line than is said fluid outlet, and restrictor means is provided in said transfer line at a location between said fluid inlet and said fluid outlet.

5. Apparatus according to claim 4, wherein said restrictor means is a venturi, and said fluid outlet connects with said transfer line at or adjacent the throat of said

6. Apparatus according to any preceding claim, wherein said compartment is defined by a cylindrical side wall, a conical base at one end of said side wall, and said cover which is located at the opposite end of said cylindrical wall, said fluid outlet is connected to said compartment interior through said conical base, and said fluid outlet is connected to said compartment interior at a location adjacent to said cover.

33135/78

7. Apparatus according to claim 6, wherein the longitudinal axes of said cylindrical side wall and said transfer line by-pass diverge away from said base.

8. Apparatus according to claim 6 or 7, wherein said cylindrical wall extends between and has its opposite ends connected to base and head members respectively; said base member having a conical recess therein forming said conical base, and contains two interconnected passages one of which defines said fluid inlet and the other defines part of said transfer line; said head member includes an annular section having attaching means thereon for cooperative engagement with said cover and contains two interconnected passages one of which defines said fluid outlet and the other defines part of said transfer line; and a conduit forming at least part of said by-pass extends between and interconnects the two said transfer line passages.

9. Apparatus according to claim 8, wherein a hook element is provided on said head member for attaching the apparatus to a support, and a conduit connection is provided on each of said head and base members for connecting said apparatus to a distribution outlet and a fluid source

10. A material distribution system including, apparatus according to any preceding claim, a soluble cartridge of material contained in said compartment, a fluid source connected to said one end of the transfer line, and a distribution outlet connected to said other end of the transfer line.

33135/78

11. A soluble fertilizer cartridge having a plurality of different nutrients dispersed substantially regularly throughout the body thereof.

12. A method of manufacturing a soluble cartridge of material, including the steps of, mixing a plurality of selected ingredients, reducing said mixture to a powder-like consistency, introducing a binding agent to said reduced mixture to produce a substantially homogenous slurry, separating measured quantities of said slurry on a sequential basis, and compressing each said separated quantity to form a rigid slug of material.

13. A method according to claim 12, wherein said ingredients are mixed to achieve a state of substantially regular distribution prior to said reducing step.

14. A method according to claim 12 or 13, wherein said mixed ingredients are reduced to substantially the same particle size before introduction of said binding agent.

15. A method according to any one of claims 12 to 14, wherein a body of said reduced ingredients is divided into a plurality of batches of predetermined size, and each said batch is isolated from the remainder of said reduced ingredients prior to introduction of said binding agent which is introduced into each said batch in turn.

binding agent is in liquid form and is introduced by passing each said batch through a spray of said binding agent liquid.

17. A method according to claim 16, wherein said binding agent is water, and the quantity of water introduced into each said batch is within the range 2-8% by weight.

331357/78

18. A method according to any one of claims 15-17, wherein said reduced ingredients are blended to achieve substantially regular distribution prior to separation into said batches.

19. A method according to any one of claims 12 to 18, wherein each said slug is subjected to infra-red drying and subsequent air cooling.

20. A soluble fertilizer cartridge formed by the method of any one of claims 12 to 17.

21. Material distributing apparatus substantially as herein particularly described with reference to what is shown in the accompanying drawings.

22. A fertilizer cartridge substantially as herein described.

DATED: 8 February, 1978

PHILLIPS, ORMONDE AND FITZPATRICK
Attorneys for:
~~DAVID LEIGH WAKE~~ AQUAFEED INDUSTRIES PTY. LTD.

David B Fitzpatrick

AUSTRALIA 344 PATENT OFFICE

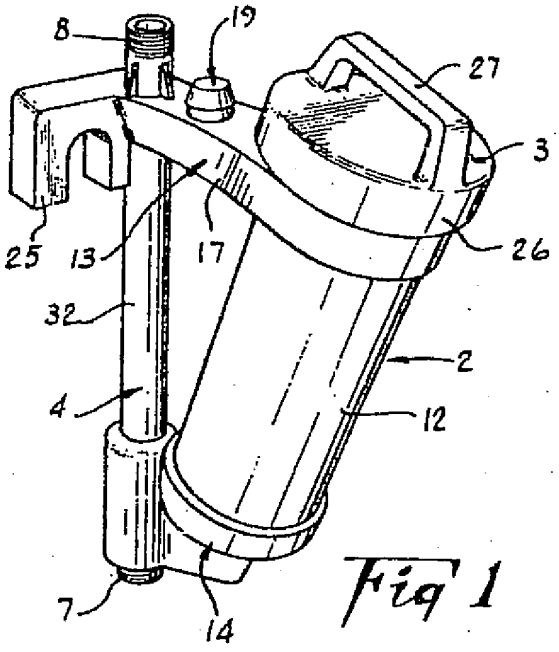


Fig 1

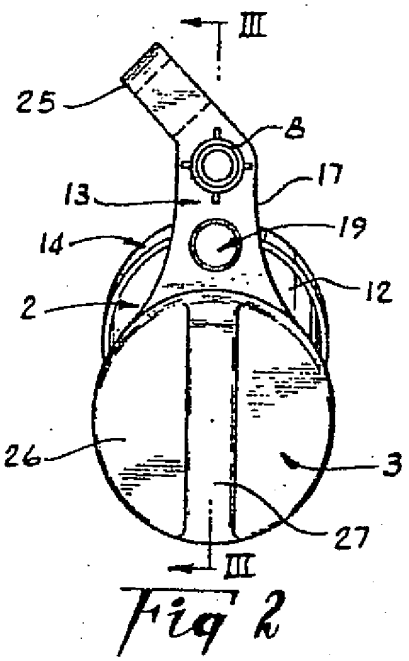


Fig 2

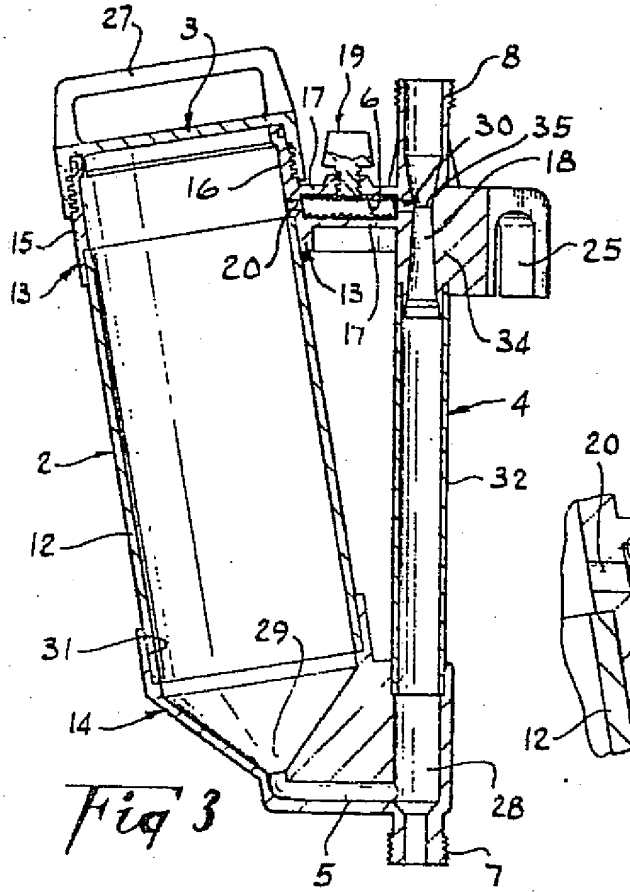


Fig 3

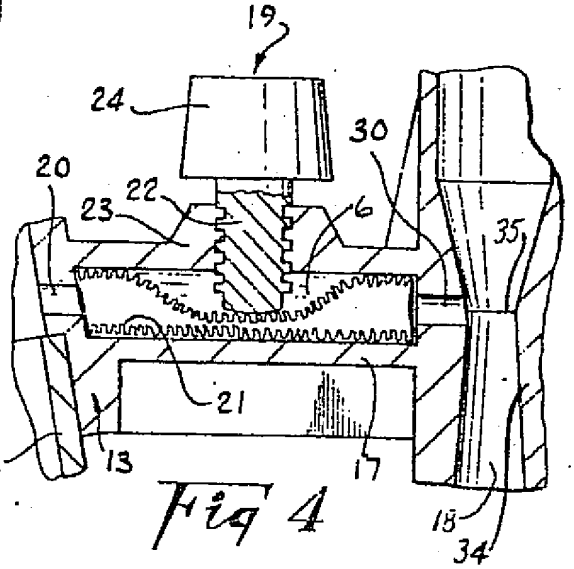


Fig 4

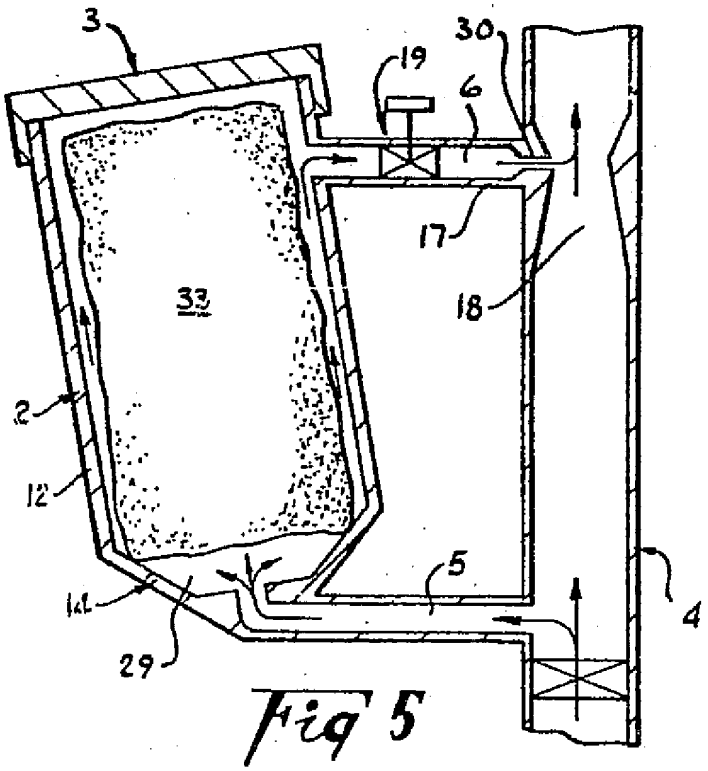


Fig 5

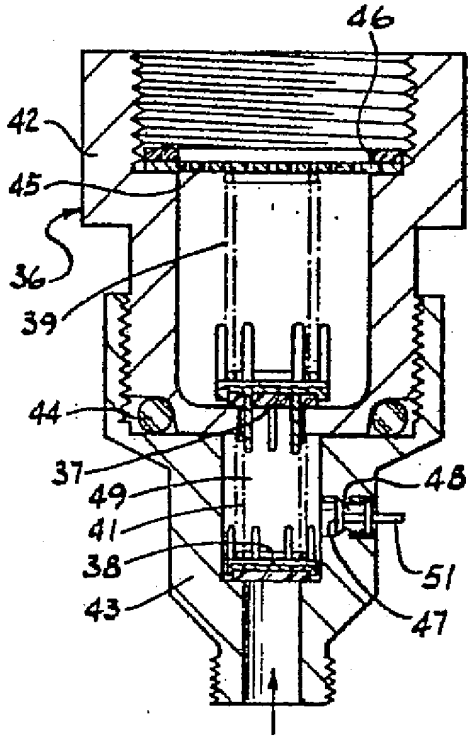
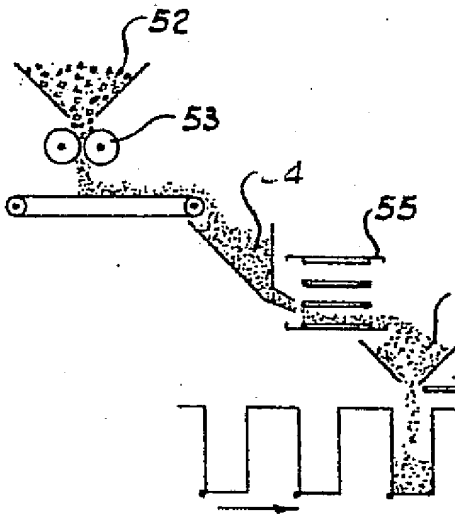


Fig 7



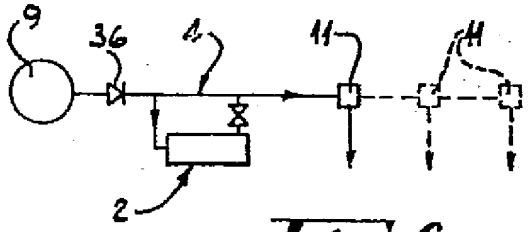


Fig 6

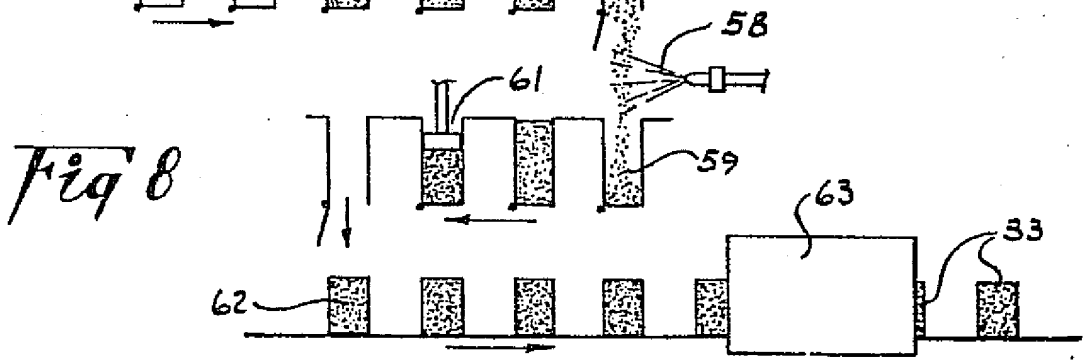


Fig 8